# TOTAL UTILITY MANAGEMENT SYSTEM IN KUWAIT

# ( K U D A M S )

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JAPAN

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## 1. ABSTRACT

The Municipality of KUWAIT, in cooperation with the ASIA CONSORTIUM which consists of MITSUI & Co., Ltd., MITSUI ENGINEERING & SHIPBUILDING Co., Ltd., and ASIA AIR SURVEY Co., Ltd. has started a 6 years project to establish a Kuwait Utility Data Management System ( KUDAMS ) for the computerization of all utility data along with topographic and/or cadastral data.

The KUDAMS project, covering almost all of the residential area in the state of KUWAIT totalling approximately 580 sq. Km , will be the biggest one in the world.

When all data are installed, Municipality of KUWAIT and any other ministries concerned could easily know the location of under ground/over head utilities with reference to the topographic data.

## 2. OUTLINE OF KUDAMS

Utilities are essential for the proper functioning of a modern city life: electricity and gas provide energy, water provide inevitable sustenance, telephone provides a means of communication, and sewerge and drainage system provide a means of sewerage disposal. Each utility must be operated and managed properly.

The state of KUWAIT is one of the most dynamic country in the world. City area ( including residential area ) is expanding day by day. As its augmentation, utility lines have to be expanding to maintain comfortable city life. KUDAMS is a system that provides data for management of all utilities.

In the KUDAMS project, the most important target is to create a data management system which will enable the KUWAIT municipality and other utility organizations to know the geographical locations of underground utilities together with reference to topographical and/or cadastral information. (Fig.1)

## 3. STATUS-QUO OF UTILITY MANAGEMENT

Each organization involved in utility service has own utility maps which have been prepared in a fashion suitable to its own needs. It was found that existing utility information maps and documents were suitable enough for individual needs from the view points of accuracy and contents of information for each organizations. Improvement could be made but information and maps now being used by each organization are well enough for their individual needs.

Each ministry has been facing cosiderable problems with regard to the administration of utility data, especially interrelations between different utilities and additional information about these utilities concerned. Separate administration of the different data as it is still done at present, will not be an appropriate concept for the future.

In order to meet the needs of a potential future administration, computerized system has to be installed for controlling the geo-related utility data on a basis of an integrated geographical data bank.

## 4. PREPARATION

All existing "As Built" drawings were collected from each ministry concerned. Total number of drawings collected are approximately 20,000 sheets. (Tab.1) It was already mentioned, however, each ministry has its own map scale and representation for his own purpose. For these reasons, comprehensive management of every drawings seems to be impossible.

In order to standardize various kinds of maps, all visible utility objects such as manholes/handholes and poles are transfered to 1:2000 scale topographic maps. (Fig.2)

Based on the information which have already been prepared by the previous stage onto the 1:2000 scale topographic maps, all utility objects will be checked in the field and signalized by paint in different colors and shapes one by one for the differentiation of a kind of utility.

## 5. SENSOR SURVEY

To detect the true location of electric cables, special sensor has been used. Sensors used by KUDAMS project are based on the principle of alternating electromagnetic field detection. For electric cable detection, field survey manuscript have been prepared before field checking to avoid the confusion for different voltages.

The results of sensor survey are recorded on the field note and will be used at the data input stage.

## 6. UTILITY DATA INPUT

Utility data input is carried out by using utility data production system in Japan in conjunction with field survey records and existing utility map information. Coordinate of utility objects are obtained by digital photogrammetric method. Line data are placed by using graphic work station with reference to the signals which were pre-painted in the filed and simple measurment (offset) data on site including sensor survey are also used. There are discrepancies between map information and actual locations of manholes/pipes because exsisting underground utility network maps were made for planning purposes and no corrections were made to the maps after the manholes/pipes had been constructed.

## 7. SYSTEM CONFIGURATION IN JAPAN

The system shown on Fig.3 - Inter Graph System - is elaborately established for speedy data inputting work in Japan. The two sets of MICRO VAX 250 with additional 16 MB memory on each CPU (Central Processing Unit) are being connected via Interbus. Total 12 graphic work stations are accessible at the same time via ETHERNET system and 14 compact 337 MB disk drives provide approximately 3.5 GB disk capacity.

The four Magnetic Tape drives of 1600/6250 BPI are used for supplementary data storage. During data inputting, since every data have been managed by 1 sq. Km wise , frequent tape work is necessary to check adjoining map data.

The three Electro Static Plotters including color plotter will help output data at any stage not only for checking but for final products.

The nine Alpha Numeric terminals including four Chinese Character terminals are being used for controlling every process in the MICRO VAX 250 systems.

The three Hard Copy units could produce quick copy of information on the screen of graphic work station.

Then these configurations will serve the data handling more ease during inputting.

In order to establish a high-volume and rapid-response interactive application system, input program have been developed by ASIA AIR SURVEY Co.,Ltd. base on the IGDS (Inter Graph Design System) original software.

FORTRAN-77 are widely used for better response and this would realize much higher system throughput.

Some important information such as manhole numbers are added automatically by batch process as an attribute data. One forth of total data have already been input and some of them are already inspected by Municipality of KUWAIT .

Final inspected data are transferred in one square kilometer block wise to the computer system of KUWAIT MUNICIPALITY which is also configured by Inter Graph system based on VAX 751 dual system by magnetic tapes. (Fig.4)

## 8. UTILITY MAP OUTPUT

Because of the existence of desert area in the KUDAMS project covering 580 sq. Km , substantial working area where utility maps to be produced is estimated approximately 300 sq. Km . In KUDAMS project, two types of utility maps will be delivered to a client as final products.

One sheet of 1:500 scale combined utility map covering 250 X 500 m on polyester film base with seven colors.

Five sheets of 1:1000 scale individual map covering 500 X 1000 m delivered to the utility ministries concerned separately plotted on synthetic paper by mono color. On these maps, two or three kinds of utility information are plotted together but no interference will be occurred by the differentiation of line type and weight.

Total number of output maps will be estimated more than 2000 sheets for 1:500 scale, 3000 sheets for 1:1000, respectively.

In order to output such huge amount of drawings within a limited contract period, mono and color electro static plotters are installed instead of conventional pen plotter. These electro static plotters designed by modern technology will ensure highly accurate, clear, stable output. Example of total utility output map is shown on Fig.5.

## 9. ACKNOWLEDGEMENTS

This report refers only to the utility data management system which have been performed in the state of KUWAIT as a part of KUDAMS project which contains topographic and cadastral map production in addition to a total utility map production.

The author wish to express great thanks to the Municipality of KUWAIT for giving us the opportunity to carry out this presentation and also to Prof. Gottfried Konency (University of Hannover) for his valuable suggestion as a consultant of this KUDAMS project.

Tab. 1 UTILITY MINISTRIES CONCERNED & NUMBER OF COLLECTED DRAWINGS

| MINISTRY | DEPARTMENT | U T I L I T Y |
|---|---|---|
| MINISTRY OF COMMUNICATION ( M O C ) | COMMUNICATION | TELEPHONE CABLE ( TEL )<br>1500 SHEETS |
| MINISTRY OF PUBLIC WORKS ( M P W ) | SEWEGE | SANITARY SEWER LINE ( SAS )<br>1200 SHEETS |
| | RAIN WATER | STORM WATER LINE ( STS )<br>800 SHEETS |
| MINISTRY OF ELECTRICITY & WATER ( M E W ) | ELECTRICITY | STREET LIGHT ( SL )<br>LOW TENSION CABLE ( LT )<br>11 KV CABLE ( HT )<br>600 SHEETS<br><br>33 KV CABLE ( 33KV)<br>132 KV CABLE (132KV)<br>300 KV CABLE (300KV)<br>700 LINES * |
| | WATER | FRESH WATER ( FRW )<br>BRACKISH WATER ( BRW )<br>2000 SHEETS |
| | GAS | GAS PIPE LINE ( GAS )<br>200 SHEETS |

* HVC drawings are made line wise and divided into several maps

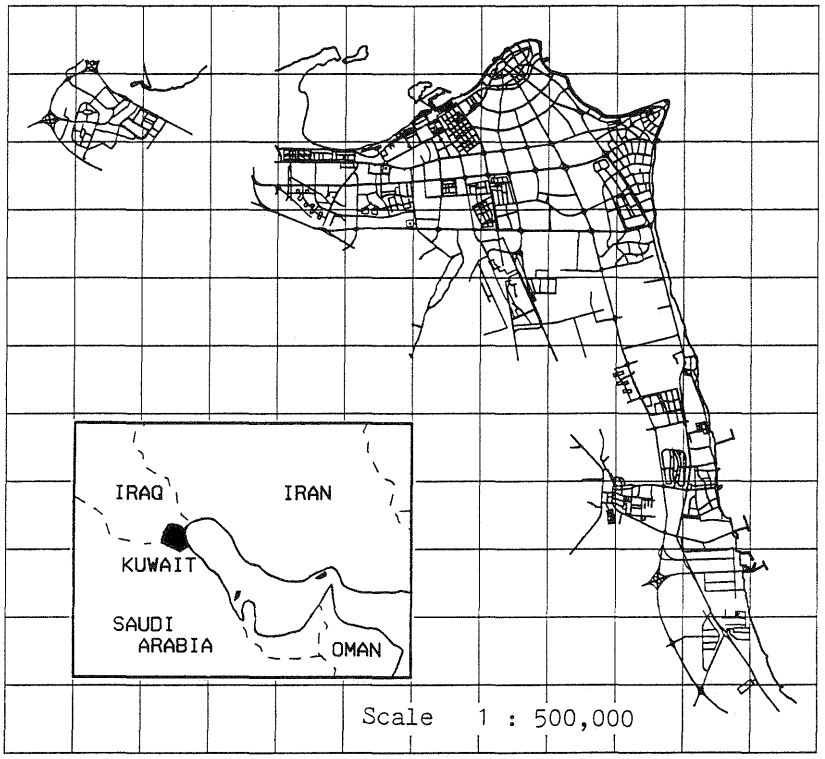


Fig. 1 THE STATE OF KUWAIT ( LOCATION & RESIDENTIAL AREA )

The state of KUWAIT locates at the bottom of the Arabian gulf.
Most of the inhabitants are along the coastal line.

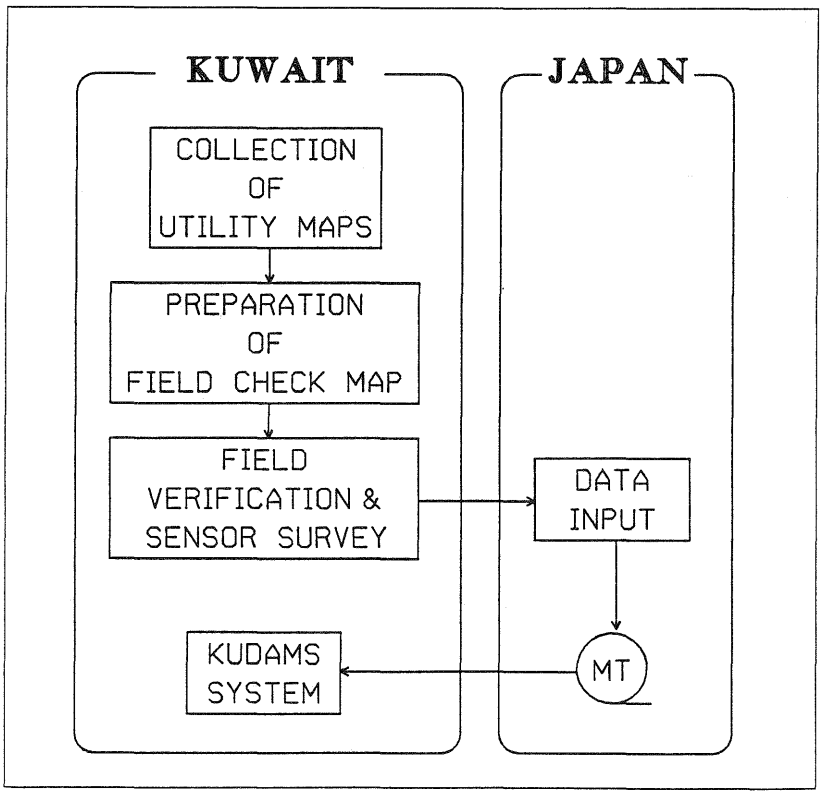


Fig. 2 UTILITY DATA FLOW

Utility data input are carried out in Japan and transfered to the KUDAMS (Kuwait Utility Data Management System) in KUWAIT by magnetic tape.

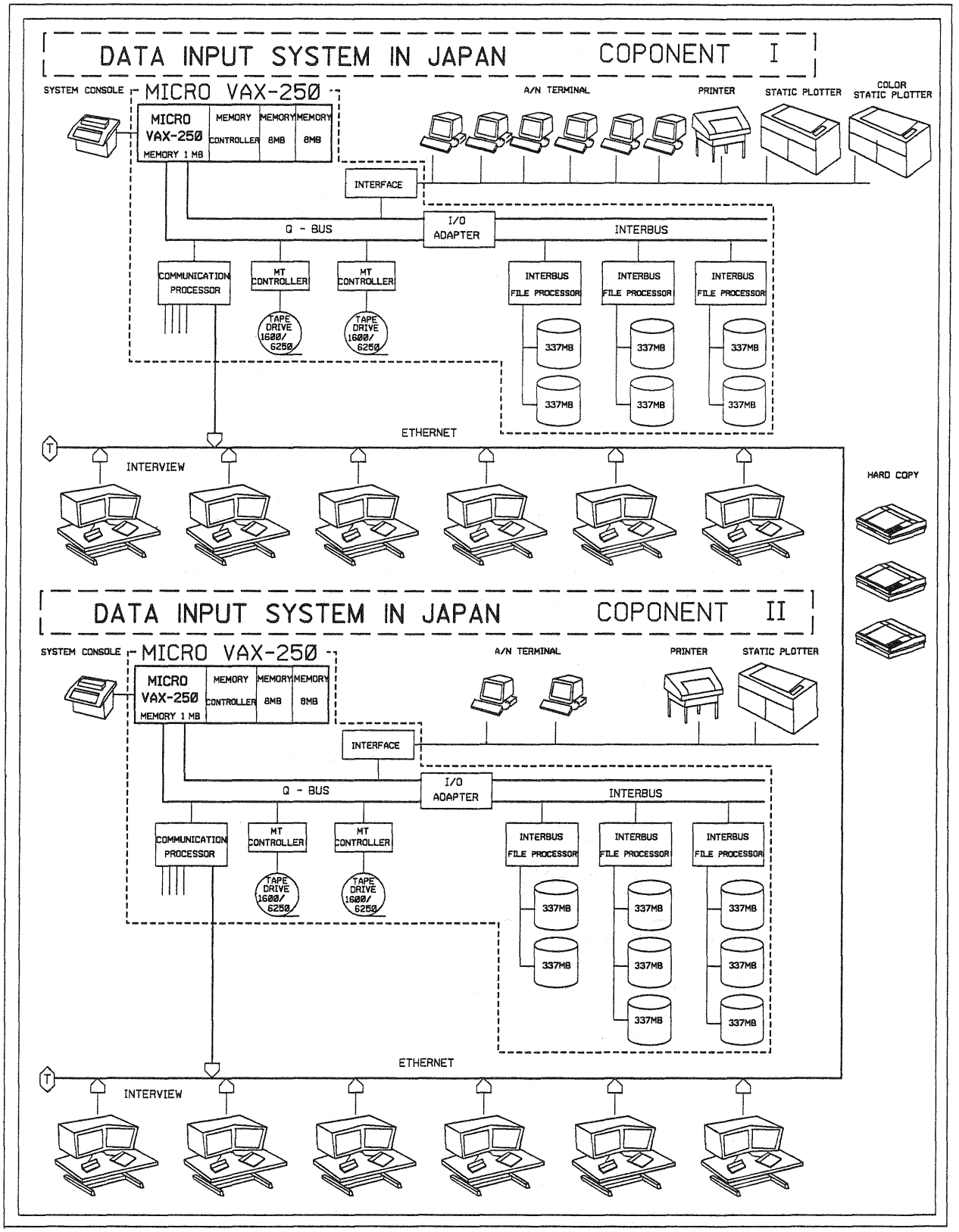


Fig. 3 CONFIGURATION OF UTILITY DATA INPUT SYSTEM IN JAPAN

Two MICRO VAX-250 systems with 12 graphic work stations will manage utility input data.

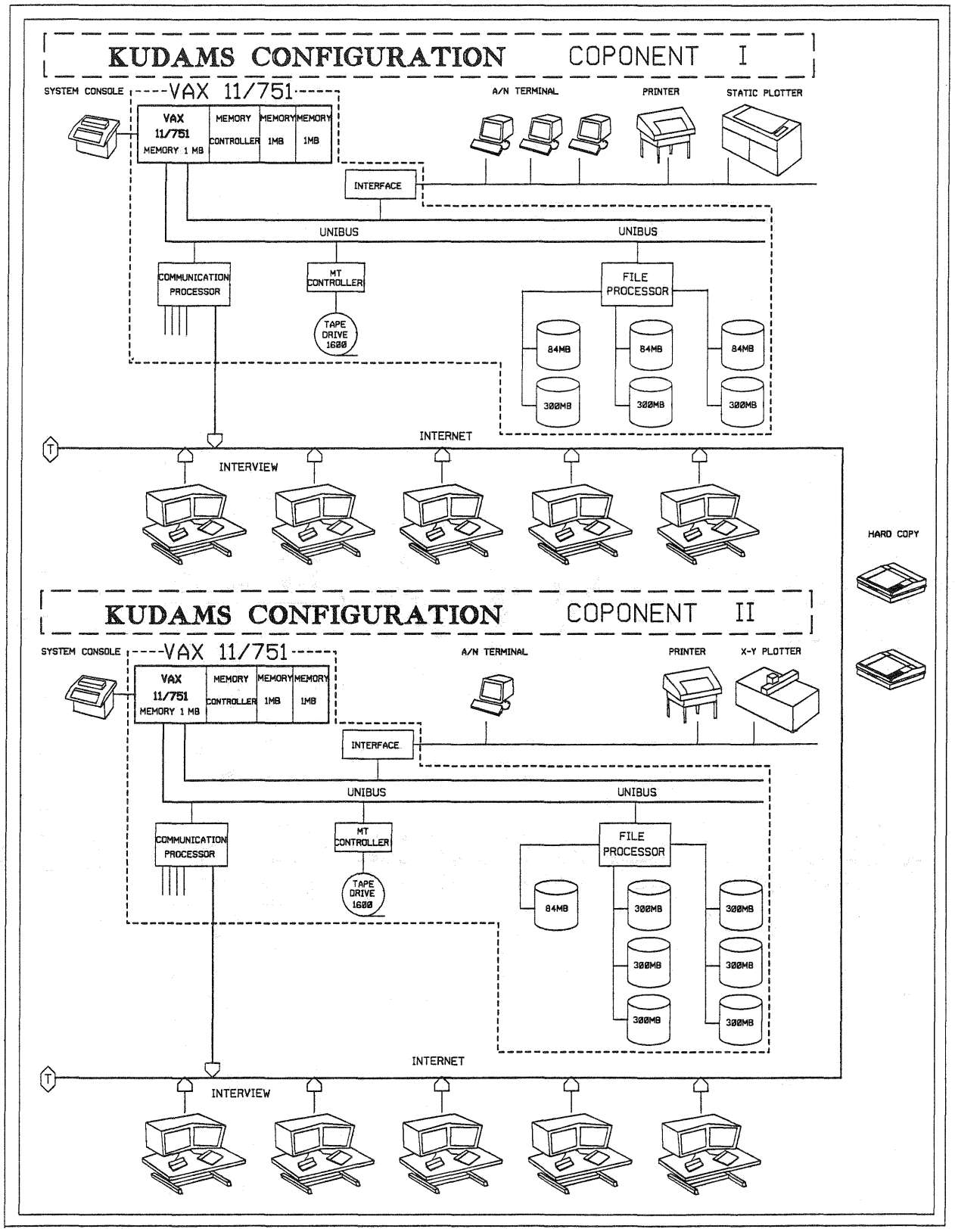


Fig. 4 CONFIGURATION OF KUDAMS

Two VAX 11/751 systems with 10 graphic work stations will manage topographic, cadastral and utility information.

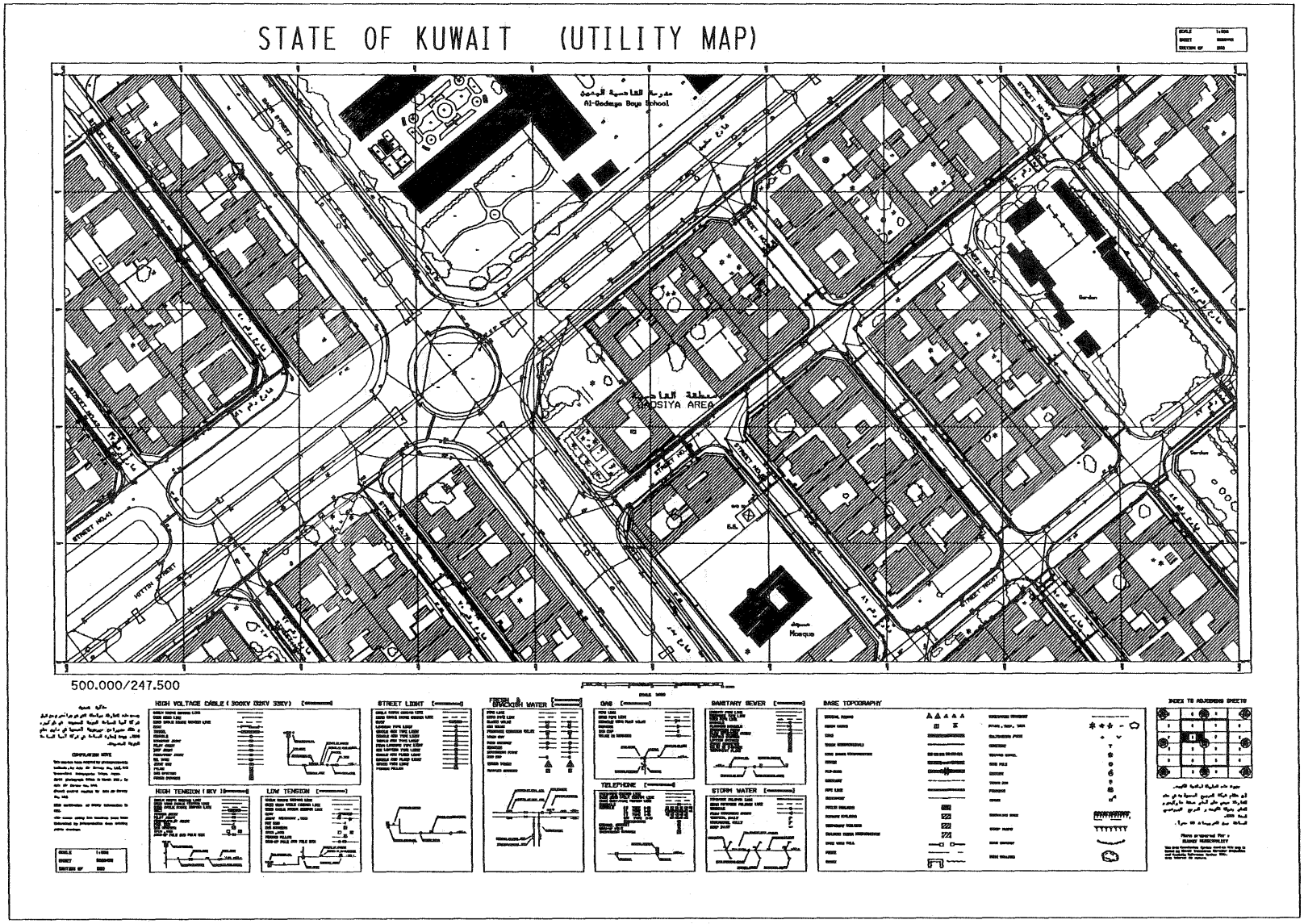


Fig. 5 OUTPUT SAMPLE OF KUDAMS ( 1:500 TOTAL UTILITY MAP )

All utility information are included with reference to topographic and cadastral data.
This 1:500 scale utility map covers 250m x 500m.